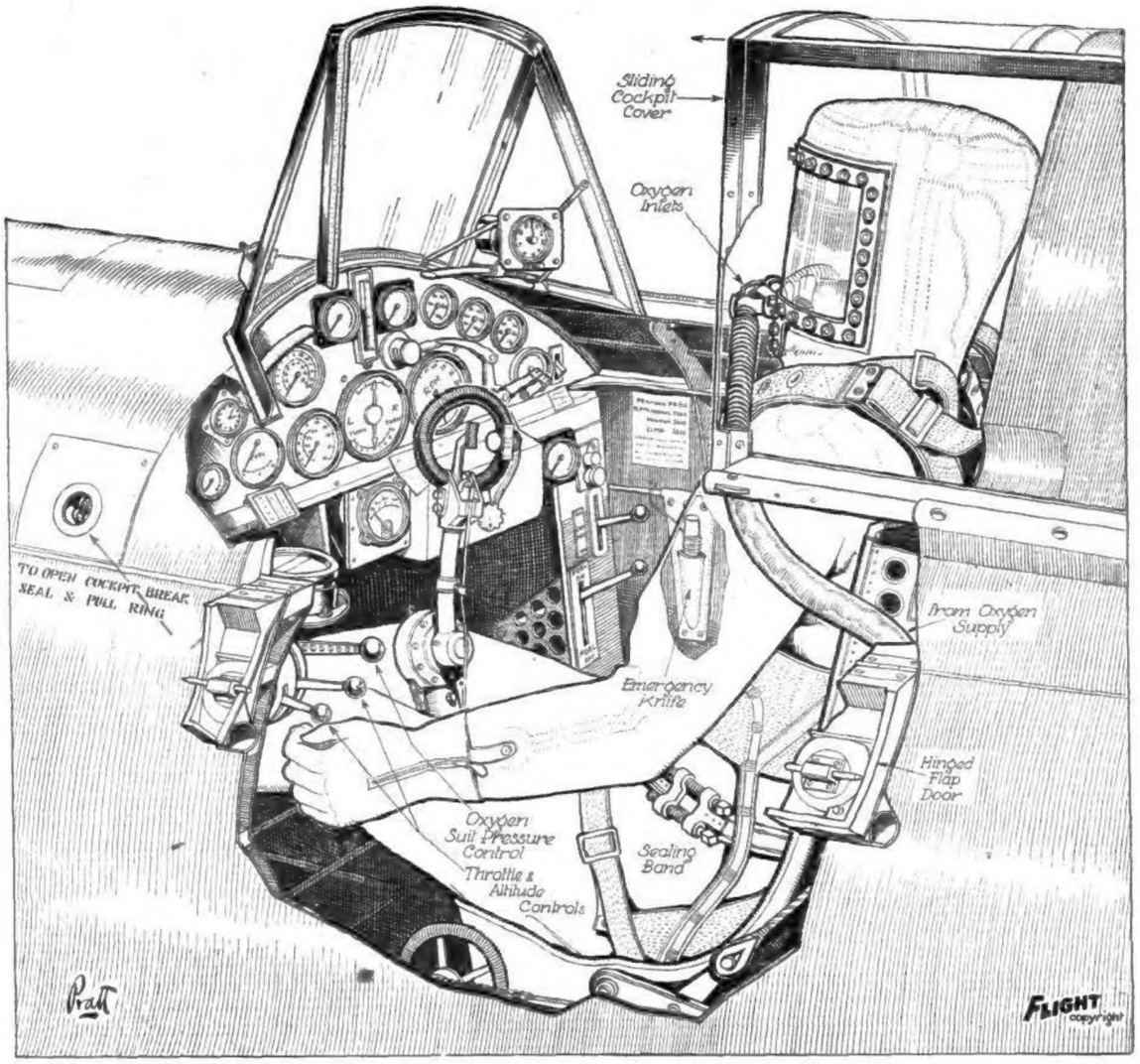


took part in the Lympne light plane trials some ten years ago. For the sake of lightness the machine is constructed mainly of wood, except, of course, the engine mounting and cowling. The original estimate for tare weight was 4,420 lb., and when the machine was finished it was found to weigh 4,391 lb., so that the original guess was very close indeed. Loaded for the altitude flight the machine weighed 5,310 lb., a figure which gives a wing loading of 8.53 lb./sq. ft. Induced drag is of great importance in an aircraft which is to have a high ceiling. In the Bristol 138 the span is 66 ft., and the span loading works out at 1.22 lb./ft.^{2}. With its large span it seems likely that the machine is the largest single-seater aeroplane ever built.

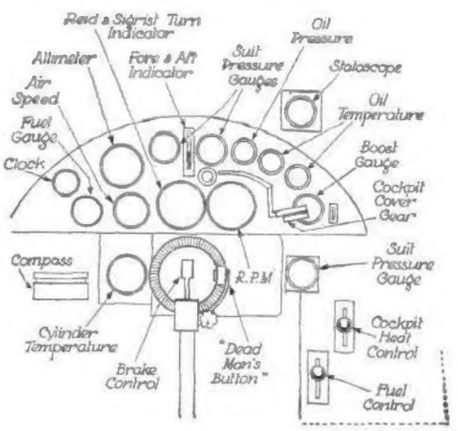
Constructional Features

Of constructional features it may be of interest to note that the wings are built in three sections, of which the central section is integral with the fuselage and has three main spars with plywood webs and mahogany flanges. The covering is plywood sheeting, known as "Teago" three-ply, in some parts less than 1 mm. thick. The fuselage is a rectangular-section *monocoque*, with plywood skin glued and screwed through the mahogany longerons and struts, the whole being faired afterwards to produce a good low-drag shape. It will be seen from the photographs that the sides of the fuselage are left flat towards the stern, probably to increase the directional stability.

An undercarriage of conventional fixed type is used. This was adopted because in a machine built for this particular purpose weight is of more importance than drag, and a retractable undercarriage, with its extra weight, was not considered worth while. Dunlop wheels and brakes are fitted.

The engine fitted in the Bristol 138 is a special type of Bristol Pegasus known as the P.E.VI S. Its most interesting feature is the two-stage blower, which gives a degree of supercharge not attainable with a single-stage unit. The blower drives incorporate clutches, so that the pilot can use the engine as a naturally aspirated engine until a certain height has been reached. This is necessary to avoid feeding too dense a charge of mixture into the cylinders at low heights. The double-stage supercharge heats up the air in the induction system, and to prevent excessive heating up, an inter-stage air cooler is mounted under the fuselage, just aft of the engine.

Numerous instruments enabled the "pressure-suited" pilot to know at any moment what his aeroplane and enginewere doing. The actual recording altimeters were carried in the wings, but an ordinary altimeter in the cockpit informed Sqn. Ldr. Swain of his height at any time during the flight.



A total petrol capacity of 82 gallons is provided, 70 gallons being carried in the lower main tank and 12 gallons in the upper, to which fuel is fed from the lower by pump. The smaller tank gives gravity feed to the engine, and its capacity suffices for about a quarter of an hour's flight. The fuel used in the altitude record flight was a special petrol developed from the standard grade of Shell Ethyl aviation gasoline of 100 Octane number, and is known as S.A.F.4. It is chiefly remarkable for its high anti-knock value, which exceeds that of pure iso-octane. The high degree of supercharge from the two-stage blower results in a high mixture temperature, and this tends to promote detonation, so that a high anti-knock value is essential. Lubrication presented its own special problems, and after much laboratory work a standard grade of Shell Aviation oil was chosen as best complying with the